[0152] A new downlink (DL) control message is proposed, which informs the UEs about the currently used size of the cooperation areas. The size of the CAs might fluctuate depending on the simultaneously served UEs and the errors with respect to their relevant CCs in an opportunistic way. For example there might be 2 or 3 predefined sets of eNBs forming the main and the sub cluster CAs, which have been announced by corresponding broadcast or multicast messages to all UEs in a certain area. During DL transmission the eNB will than send as additional PDCCH information the actually selected size/set of the CAs with 1 to 2 bits.

[0153] The size of the cooperation area depends on the CCs actually used. Thus, the above downlink control message comprises information indicating which CCs are used and/or which CCs are not used.

[0154] As the channel prediction accuracy will get worse over time as one special solution the CA size might be set to maximum at the beginning of the prediction frame and in case the CA size has been shrinked for one of the PRBs it will be kept at this small size. In this way UEs can limit their further UL CSI feedback to the CCs of the shrinked CA.

[0155] The embodiments described above achieve the following benefits:

[0156] Embodiments of the present invention improve the robustness. That is, by the embodiments, the main challenge for JT CoMP implementations so far is solved, especially in combination with advanced channel prediction. As JT CoMP is separated into orthogonal sub problems over lower size sub cooperation areas the robustness against channel estimation and prediction errors can be significantly improved. Note, with increasing number of channel components the probability of precoding errors due to one or few badly predicted channel components raises drastically.

[0157] Assuming an operating point below full load—e.g. at 80% of full load—there will be room for some coordinated scheduling or beamforming and intra cooperation area interference will be often suppressed to a similar level as possible for full JT CoMP transmission over the large cooperation area, but with a significantly increased robustness against precoding errors do to the smaller size of the sub CAs.

[0158] A smart combination for the overall OP CoMP precoder of JT COMP, CB/CS, IRC processing, MU scheduling, smart antenna TX beamforming, power adaptation, antenna tilting, etc, results in a hybrid solution exploiting the best of each technique.

[0159] FIG. 10 illustrates an opportunistic (OP) CoMP scheduler as it might be used in the future. Taking much more information for scheduling into consideration as today. In detail, the opportunistic CoMP scheduler shown in FIG. 10 combines beside load, QoS and CSI information (PMI) as known for SoA schedulers furthermore failed prediction reports, reliability maps, CSI prediction reports, relative pathloss information and location or context awareness. Not shown—but relevant as well—are e.g. UE capabilities like IRC performance.

[0160] Thus, an opportunistic (OP) CoMP scheduler as described above may use the following information, for example:

　[0161] failed prediction map very 5 ms per UE, PRB, WB beam,

　[0162] reliability map every 100 ms,

　[0163] CSI prediction every 100 ms (200 MPCs, 10 bit/CC, ~5 CCs),

　[0164] UE cancellation capabilities every 100 ms (2 bit/CC, ~10 CCs),

　[0165] RSRP=pathloss every 1 s, per UE, per CA,

　[0166] Queue length every 1 ms (QoS (best effort, CBR, . . .),

　[0167] BVDM update every 10 s (context aware information)

　[0168] Power normalization loss every 4 ms, per user group, PRB, ...

[0169] The above list is only an example, and also the reporting intervals for the different kinds of information are only examples.

[0170] Based on the received information, the OP CoMP scheduler establishes a CoMP scheme (CS, DCS, JT . . .).

[0171] It is noted that the embodiments and the present invention in general is not limited to the specific examples given above.

[0172] For example, instead of only reporting of failed CCs some further information how the CSI should be adapted might be send, e.g. a certain phase offset or amplitude change with respect to the predicted CSI.

[0173] The reporting of errored CCs is typically based on thresholds. For that reason a proper definition of these thresholds will have to be standardized, e.g. like power with respect to RSRP or with respect to power on certain PRB etc.

[0174] Small cells might be connected to the backbone over different access techniques with different capacities and latencies. Due to different delays channel prediction from different small cells will have different reliabilities. That way the varying backhaul performance can be taken into account over the reliability matrix at the OP CoMP precoder and/or the low rate low latency feedback channel. Small cell UEs might send the information about failed CCs either directly to the eNB or first to the small cell, which relays this information then to the eNB over the backbone infrastructure. In case of fibers the extra delay can be small, while the overall capacity of the low latency low rate UL feedback channel can be increased.

[0175] Beside mis-predicted channel components also missing user data at certain time instants at certain sites participating in the cooperation might trigger a temporarily reduction of the size of the CAs.

[0176] In case of many failed CCs (or missing user data) a fast fallback mode might be used like CS instead of JT CoMP or potentially an interference alignment precoder. In combination with predictive scheduling there might be no chance to inform the UEs about the changed transmission scheme. In that case UEs might be doing blind decoding attempts for a limited set of predefined transmission strategies in case they are not able to decode with the first expected decoding scheme (e.g. JT CoMP over full cooperation area). This is relevant e.g. in case of specific feed forward filters maximizing JT CoMP capacity. In case of CS or DCS these filters should be replaced by conventional MMSE or IRC filters adapting to the DMRS. The UEs have to be informed by corresponding messages about the transmission schemes the eNB will consider in future DL transmissions to prepare for corresponding Rx processing.

[0177] Backhaul transmission of user data might be adapted on the fly based on the eNB decisions about best fitting size of the CAs so that backhaul overhead is minimized.

[0178] In case of lossless compression the reporting threshold for errors might be adapted so that the e.g.